

Telegraphic Determination of the Longitude of Haiphong.
By Dr. W. Doberck.

(Communicated by the Astronomer Royal.)

The determination of the longitude of Haiphong was undertaken at the proposal of M. La Porte, Chef de la Mission Hydrographique du Tonkin, and effected through the cable of the Eastern Extension, Australasia and China Telegraph Company, which was placed at our disposal for a short time on three consecutive evenings at the request of the Résident-Général du Tonkin. The telegraphists at both stations assisted us with the great courtesy always experienced from that Company in matters of public interest by scientific men in different parts of the world. Unfortunately, owing to the approaching departure from Haiphong of M. La Porte, there was not much time to make detailed arrangements beforehand.

Signals were exchanged on the 5th, 6th, and 7th April, 1887. The weather was clear at both stations, and transit observations of a sufficient number of stars were obtained each night both in Haiphong and in Hongkong. The small observatory in Haiphong is placed beside the Post Office "à 310 m. dans l'ouest du point marqué Pagode de l'Observatoire sur le plan français 3506 (Plan des Environs de Haiphong et de Quang-Yen)." The masonry pier on which the transit instrument is placed was constructed more than a year ago. The transits were observed by M. La Porte with a sidereal chronometer, which was, on the two first nights, carried down to the telegraph office for use in exchanging signals, being compared before and after this transport with a chronometer that remained in the observatory. On the last night the sidereal chronometer remained in the observatory, and was compared with a mean-time chronometer by aid of which the signals were exchanged.

The observations in Hongkong were made with the transit instrument and the sidereal standard clock. Mr. F. G. Figg made the observations and comparisons on the 6th, and I myself observed and compared on the 5th and 7th. The standard clock was compared with two mean-time chronometers which were carried across the harbour in a steam launch. After our return the chronometers were again compared. Inter-comparisons in the telegraph office proved the regularity of their rate in the meantime. They were used alternately in the exchange of the signals.

The signals were made and observed as follows:—The attention of the observer at the other station was called by a number of taps, and half a minute later eight or nine signals were given at every ten seconds on the chronometer by depressing the key. After changing the observer and chronometer in Hongkong attention was again called and another series sent. The signals

consisted in deflections of the ink-writer on Sir W. Thomson's Patent Siphon Recorder, and were observed by eye and ear with the chronometers by M. La Porte, in Haiphong, or by the two observers in Hongkong. Subsequently the Haiphong and Hongkong Mean Times of the mean of each series of signals were obtained as explained above, and they are exhibited in the following table.

1887, April 5.

From	To	Observer.	H. K. M.T.			Hph. M.T.			Difference.		Longitude.	
			H. K.	Hph.	D. P.	h	m	s	h	m	s	m
H. K.	Hph.	H. K.	8 47 14.27			8 17 16.66			29 57 61			29 57.95
"	"	F.	8 49 21.70			8 19 24.08			57.62			57.96
Hph.	H. K.	D.	8 53 45.48			8 23 47.10			58.38			58.04
"	"	F.	8 53 45.67			"			58.57			58.23
"	"	"	9 0 14.24			8 30 15.99			58.25			57.91
"	"	D.	9 0 14.24			"			58.25			57.91
"	"	F.	9 4 23.50			8 34 25.32			58.18			57.84
"	"	D.	9 4 23.65			"			58.33			57.99
"	"	F.	9 11 12.40			8 41 14.18			58.22			57.88
"	"	D.	9 11 12.43			"			58.25			57.91
H. K.	Hph.	"	9 14 51.70			8 44 53.98			57.72			58.06
"	"	F.	9 18 54.44			8 48 56.88			57.56			57.90

1887, April 6.

H. K.	Hph.	D.	8 44 20.84			8 14 23.36			57.48			57.71
"	"	F.	8 46 20.64			8 16 23.14			57.50			57.72
Hph.	H. K.	D.	8 55 1.76			8 25 3.82			57.94			57.72
"	"	F.	8 55 1.84			"			58.02			57.79
"	"	D.	8 56 31.43			8 26 33.58			57.85			57.62
"	"	F.	8 56 31.53			"			57.95			57.73

1887, April 7.

H. K.	Hph.	D.	8 32 7.53			8 2 10.15			57.38			57.66
"	"	F.	8 40 0.14			8 10 2.57			57.57			57.85
"	"	D.	8 43 41.14			8 13 43.62			57.52			57.80
"	"	F.	8 44 37.56			8 14 40.05			57.51			57.79
Hph.	H. K.	D.	8 48 19.56			8 18 21.63			57.93			57.65
"	"	F.	8 48 19.68			"			58.05			57.77
"	"	D.	8 50 19.65			8 20 21.62			58.03			57.75
"	"	F.	8 50 19.85			"			58.23			57.95

Taking the mean of the differences of time obtained by sending the current in either direction, and then subtracting the smaller from the greater, and dividing by two the amount of retardation due to induction owing to the electro-static capacity of the cable—which is all underground or under water, being insulated by gutta-percha, and 498·6 miles in length—we obtain the retardation. It was on the three nights respectively :— $0^s.34$, $0^s.225$, and $0^s.28$, or on an average $0^s.282$. After correcting the observed differences of time for retardation, the different values of the observed longitude of Haiphong west of Hongkong, exhibited above, were obtained.

The means of the results obtained by M. La Porte in Haiphong and the two observers in Hongkong are as follows :—

	Observers.		Mean.
	P. and D. m s	P. and F. m s	
1887, April 5	29 57'977	29 57'953	29 57'965
„ 6	·683	·747	·715
„ 7	·715	·840	·778
Mean	29 57'792	29 57'847	29 57'819

The longitude of the transit instrument in the Hongkong Observatory is, according to observations made in 1881 by Lieut.-Commander Green, U.S.N., who connected Hongkong with both Madras and Wladiwostock :— $7^h 36^m 41^s.86$ east of the meridian of the Royal Observatory, Greenwich, therefore the longitude of the transit instrument in Haiphong is :—

$$7^h 6^m 44^s.04 \text{ east of Greenwich.}$$

The probable error of the longitude of Hongkong does not appear to be much more than a tenth of a second, and the probable error of the difference being about a twentieth of a second, it follows that the probable error of the longitude of Haiphong is below a fifth of a second.

Hongkong Observatory:
1887, December 23.

Ephemeris for Physical Observations of the Moon for the Nine Lunations from April 12 to the end of 1888. By A. Marth.

Greenwich Noon. 1888.	Selenographical Colong. Lat. of the Sun.		Geocentric Libration.		
	Long. of the Earth.	Lat. of the Earth.	Amount.	Direction.	
April 12	282°50	-1°48	-0°24	+6°54	6°54 2°1
13	294°72	1°49	1°52	6°42	6°60 13°3
14	306°95	1°50	2°81	6°02	6°64 24°9
15	319°17	-1°50	-4°07	+5°36	6°73 37°1
16	331°38	1°51	5°26	4°46	6°90 49°6
17	343°59	1°52	6°33	3°35	7°15 62°0
18	355°80	1°52	7°19	2°06	7°48 74°0
19	8°00	1°53	7°77	+0°64	7°80 85°3
20	20°20	1°53	7°99	-0°85	8°03 96°1
21	32°39	1°54	7°76	2°35	8°11 106°9
22	44°57	-1°54	-7°04	-3°75	7°98 118°2
23	56°75	1°55	5°81	4°97	7°65 130°7
24	68°93	1°55	4°12	5°90	7°19 145°2
25	81°20	1°55	-2°09	6°43	6°76 162°1
26	93°27	1°55	+0°12	6°51	6°51 181°1
27	105°44	1°55	2°29	6°13	6°54 200°5
28	117°61	1°54	4°23	5°31	6°79 218°4
29	129°79	-1°54	+5°79	-4°16	7°13 234°2
30	141°97	1°53	6°87	2°78	7°41 247°9
May 1	154°16	1°53	7°45	-1°28	7°56 260°2
2	166°36	1°52	7°57	+0°25	7°57 271°9
3	178°57	1°51	7°28	1°71	7°48 283°3
4	190°78	1°51	6°66	3°05	7°32 294°7
5	203°00	1°50	5°78	4°23	7°16 306°3
6	215°22	-1°49	+4°73	+5°16	6°99 317°6
7	227°45	1°49	3°56	5°91	6°90 329°1
8	239°69	1°48	2°32	6°37	6°77 340°1
9	251°92	1°47	+1°04	6°54	6°62 351°0
10	264°16	1°46	-0°24	6°44	6°44 2°1
11	276°40	1°46	1°51	6°05	6°24 14°0
12	288°64	1°45	2°76	5°40	6°06 27°0
13	300°88	-1°45	-3°94	+4°51	5°98 41°1
14	313°12	1°44	5°04	3°34	6°04 56°4
15	325°35	1°43	6°03	2°13	6°39 70°5

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